REMARKS

Claims 7-12 are pending in the present application. Species A including claims 7-12 has been elected for examination. Claims 13-21 have been canceled as being directed to a non-elected Species. Applicants respectfully reserve the right to file a divisional application including non-elected claims 13-21.

Preliminary Amendment

The Preliminary Amendment filed on June 29, 2001, has not been entered as allegedly failing to comply with 37 C.F.R. 1.121. Accordingly, the various amendments to the specification have been resubmitted in this response. **Also, a version with marked-up changes has been resubmitted**.

Applicants respectfully submit that the amendments to the specification are in particular compliance with 37 C.F.R. 1.121(b)(1)(i)-(iii). Accordingly, the Examiner is respectfully requested to enter the above noted amendments to the specification. In the event that these amendments to the specification are denied entry, the Examiner is respectfully requested to particularly establish on the record why the amendments have been deemed to not be in compliance with 37 C.F.R. 1.121.

Claims 7 and 8

The Examiner has alleged that claim 8 is a substantial duplicate of claim 7, and that an obviousness double patenting rejection may be forthcoming unless the claims are amended accordingly. Applicants respectfully disagree for the following reasons.

As set forth in Manual of Patent Examining Procedure section 804(I), a double patenting issue may arise between two or more pending applications, between one or more pending applications and a patent, or between one or more pending applications and a published application. A double patenting issue may also arise in a reexamination proceeding between the patent claims being reexamined and the claims of one or more applications and/or patents. MPEP Section 804(I) does not establish that a double patenting issue arises between pending claims of a single application. Accordingly, the Examiner's assertion that either of claims 7 and 8 of the present application may be subject to an obvious double patenting rejection in view of the other of claims 7 and 8, is clearly improper.

Applicants further respectfully emphasize that claims 7 and 8 of the present application are not substantial duplicates of each other as asserted by the Examiner. Particularly, the preamble of claims 7 and 8 are respectively different from each other, such that the scope of the claims are not the same. Accordingly, the Examiner is respectfully requested to reconsider and examine both claims 7 and 8.

Conclusion

Favorable consideration and early allowance of the present application are earnestly solicited.

In the event that there are any outstanding matters remaining in the present application, please contact Andrew J. Telesz, Jr. (Reg. No. 33,581) at (703) 715-0870 in the Washington, D.C. area, to discuss these matters.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 50-0238 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

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Enclosures: Version with Marked-Up Changes

Abstract of the Disclosure

A method of transfer molding, wherein a top-half mold and a bottom-half mold of an apparatus form a plurality of cavities interconnected, and wherein a pressure adjuster reduces the pressure of the cavities every time a specified amount of resin is supplied into any one of a plurality of cavities.

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VERSION WITH MARKED-UP CHANGES

Additions/Deletions to the Specification:

Page 1, lines 9-20:

In the manufacture of semiconductor devices, transfer molding apparatuses for encapsulating semiconductor devices mounted on lead frames are conventionally used. As shown in Fig.7, the transfer molding apparatus comprises a transfer pot 10 into which solid thermosetting resin (tablets) is loaded, a plunger 12 for transferring the thermosetting resin 28 (hereafter referred to as the resin 28. See Fig.8) that has been fluidified in the transfer pot, a position sensor 14 for detecting the position of the plunger 12, a top-half mold 16a fixed to a top platen 26a, a bottom-half mold 16b fixed to a bottom-half platen 26b, heaters 18 for heating the top-half and bottom-half molds 16a, 16b to a predetermined temperature, and a suction pump 24 for reducing the pressure in the cavities 20 by extracting the air from a chamber 30 where the top-half and bottom-half molds 16a, 16b are disposed.

Page 2, lines 6-15:

Referring to Fig.8, description will be made of a method of manufacturing semiconductor devices on a transfer molding apparatus structured as described above. Fig.8 shows only the principal portions for convenience of explanation. First of all, a semiconductor-device-mounted lead frame (not shown) is set in the bottom-half mold 16b, a resin tablet is loaded in the transfer pot 10, and by lowering the top platen 26a,

the top-half mold 16a and the bottom-half mold 16b are closed, so that a cavity 20, for example, is formed as shown in Fig.8 (a). At this point in time, the semiconductor device has been placed almost in the center of the cavity 20. In addition, the pressure in the chamber 30 has been reduced to about 30 to 99Pa by the suction pump 24.

Page 3, lines 6-12:

In the transfer molding apparatus constructed as described, there are possibilities of an unfilled region (voids) 29 being formed in the top-cavity portion or the bottom-cavity portion of the mold due to a difference in resin-filling speed between the top-cavity portion and the bottom-cavity portion, which partition is made by the semiconductor element loaded in the cavity 20. Voids are unwanted because they give rise to a warp or deformation in the package or decreases its strength or humidity resistance.

Page 4, lines 24-25:

a pressure adjuster [pressure adjusting means] for reducing the pressure in the cavity when a specified amount of resin has been injected into the cavity.

Page 4, line 26 through to page 5, line 4:

Because the pressure adjuster [adjusting means] reduces the pressure in a cavity after a specified amount of resin has been injected into the cavity, the cavity is at normal pressure at a point in time when the supply of a specified amount of resin is

finished and the pressure difference between the pressure in the cavity and the pressure in the resin is relatively small. Therefore, the air bubbles in the resin can be prevented from expanding remarkably.

Page 5, lines 6-11:

Because the pressure adjuster [adjusting means] reduces the pressure in a cavity when a specified amount of resin has been injected into the cavity, the remaining air in the unfilled region of the top cavity portion or the bottom cavity portion can be decreased, so that the voids can be reduced, which occur due to a difference in filling [filing] rate between the top cavity portion and the bottom cavity portion.

Page 5, lines 12-15:

In the transfer molding apparatus described above, the top-half mold and the bottom-half mold form a plurality of interconnected cavities, and the pressure adjuster [adjusting means] reduces the pressure of the cavities every time any one of the plurality of cavities is supplied with a specified amount of resin.

Page 5, line 22 through to page 6, line 1:

Further, in the transfer molding apparatus, the pressure adjuster [adjusting means] has a position detector [detecting means] for detecting the position of the plunger, and reduces the pressure in each cavity by detecting the plunger position at a point in time when the cavity has been supplied with a specified amount of resin. By

using this mechanism, the injected amount of resin can be detected with high accuracy, which makes it possible to suitably control timing of pressure reduction by the pressure [adjusting means] adjuster.

Page 6, lines 2-6:

In the transfer molding apparatus described above, the pressure adjuster [adjusting means] has a time counter [counting means], and reduces the pressure in a cavity when the time counter [counting means] has counted a set length of time from the start of movement of the plunger until the cavity is supplied with a specified amount of resin.

Page 6, lines 7-12:

More specifically, a length of time from the start of plunger movement until the cavity is supplied with a specified amount of resin is measured, and at the end of a preset time, the pressure adjuster [adjusting means] reduces the pressure in the cavity. Therefore, it is possible to detect the injected amount with high accuracy, and suitably control timing of pressure reduction by the pressure adjuster [adjusting means].

Page 6, lines 18-24:

In other words, according to the method according to the present invention, because the pressure in a cavity is not reduced until the cavity is [not] supplied with a specified amount of resin, the cavity prior to injection of resin is maintained at normal

pressure. For this reason, a pressure difference between the pressure in the resin and the pressure in the cavity is relatively small when the cavity has been supplied with resin. Therefore, the entrapped air in the resin can be prevented from expanding remarkably.

Page 7, lines 8-9:

[Fig. 2 is a] Figs. 2(a)-2(d) are fragmentary [diagram] diagrams for explaining the motion of the transfer molding apparatus shown in Fig.1;

Page 7, lines 12-13:

[Fig. 4 is a] Figs. 4(a)-4(d) are fragmentary [diagram] diagrams for explaining the motion of the transfer molding apparatus shown in Fig.3;

Page 7, lines 16-17:

[Fig. 6 is a] Figs. 6(a)-6(d) are fragmentary [diagram] diagrams for explaining the motion of the transfer molding apparatus shown in Fig.5;

Page 7, lines 18-19:

Fig.7 is a sectional view showing a schematic construction of [the] a conventional transfer molding apparatus; and

Page 7, lines 20-21:

[Fig. 8 is a] Figs. 8(a)-8(d) are fragmentary [diagram] diagrams for explaining the motion of the transfer molding apparatus shown in Fig.6.

Page 7, line 27 through to page 8, line 13:

A first embodiment will be described with reference to Figs.1 and 2. As shown in Fig.1, the transfer molding apparatus according to the first embodiment comprises a top-half mold 16a fixed to a top platen 26a; a bottom-half mold 16b fixed to a bottom platen 26b; heaters 18 for heating the top-half and the bottom-half molds 16a, 16b to a predetermined temperature; a transfer pot 10, formed by the top-half and the bottom-half molds, for accepting a tablet of a thermosetting resin, an epoxy resin for example, formed by the top-half and the bottom-half molds 16a, 16b; a plunger 12 for extruding the resin 28 melted in the transfer pot 10; a position sensor 14 for detecting the position of the plunger 12; a suction pump 24 for reducing the pressure in a chamber 30, having the top-half mold 16a and the bottom-half mold 16b installed therein, [to] thereby placing the cavities 20 at reduced pressure; and a pressure controller 40 for controlling the drive of the suction pump 24 according to the amount of movement of the plunger 12.

Page 8, lines 14-19:

When the top-half mold 16a and the bottom-half mold 16b are closed, two cavities 20 as molding spaces for packages and two runners [20] 22 for guiding the

resin into the cavities 20 through gates 23, which are open to the cavities 20, are formed. The runners (distribution paths) 22 are provided on both sides of the transfer pot 10 and communicate with each other through the transfer pot 10.

Page 9, lines 19-24:

The position sensor 14 is detecting the position of the plunger 12 from the start of its movement. As shown in [Fig.2(a)] Fig. 2(b), the position sensor 14 outputs a detection signal to the pressure controller 40 when the position sensor 14 detects that the leading end of the plunger 12 has reached the position B, which indicates that a specified amount of resin has been supplied from the runner 22 into the cavity 20.

Page 10, line 26 through to page 11, line 5:

After the resin 28 has been sufficiently cured, the top platen 26a (see Fig.1) is raised, and a semiconductor device with a lead frame in a package of resin 28 that hardened around the semiconductor element is ejected. Subsequently, the excess resin remaining in the runner 22 or the like is removed, the package is [whittle] whittled down to shape, the frame portion of the lead frame is trimmed, and the outer leads are formed. Thus, a semiconductor device is obtained.

Page 11, line 21 through to page 12, line 6:

Referring to Figs.3 and 4, a second embodiment of the present invention will be described. As shown in Fig.3, the transfer molding apparatus according to the second

embodiment comprises a top-half mold 16a fixed to a top platen 26a; a bottom-half mold 16b fixed to a bottom platen 26b; heaters 18 for heating the top-half and the bottom-half molds 16a, 16b to a predetermined temperature; a transfer pot 10, for accepting a tablet of a thermosetting resin, an epoxy resin for example, formed by the top-half and the bottom-half molds 16a and 16b; a plunger 12 for extruding the resin 28 melted in the transfer pot 10; a suction pump 24 for reducing the pressure in the chamber 30, having the top-half and the bottom-half molds 16a, 16b installed therein, [to] thereby placing the cavities 20 at reduced pressure; and a pressure controller 42 [(pressure adjusting means)] for controlling the drive of the suction pump 24 according to the amount of movement of the plunger 12.

Page 12, lines 7-9:

When the top-half mold 16a and the bottom-half mold [16bare] 16b are closed, two runners (distribution paths) 22 for guiding the resin into the cavities 20 through gates 23, which are open to the cavities 20 are formed.

Page 13, lines 12-20:

The timer 42a starts counting time from the start of plunger movement, and as shown in Fig.4(b), when the leading end of the plunger 12 has moved from position A to position B and the timer 42a [came] counts to time t1 that indicates a specified amount of resin 28 has been supplied from the runner 22 into the cavity 20, the timer 42a outputs a detection signal to the pressure controller 42. On receiving a detection signal

from the timer 42a, the pressure controller 42 sends a drive start signal to the suction pump 24. In response to the drive start signal, the suction pump 24 starts to extract the air from the chamber 30, thus reducing the pressure in the chamber 30 to about 30 to 99Pa.

Page 16, line 24 through to page 17, line 2:

The position sensor 14 [is detecting] detects the position of the plunger 12 from the start of its movement. As shown in Fig.6(a), the position sensor 14 outputs a detection signal to the pressure controller 40 when the position sensor 14 detects that the leading end of the plunger 12 has reached the position A, which indicates that a specified amount of resin has been supplied from the first runner 22a into the first cavity 20a.

Page 17, line 25 through to page 18, line 4:

[Subsequently] Subsequent to as shown in Fig. 6(b), when the cavity 20a has been filled with the resin 28 [till] once the plunger 12 moves [to] past the position B, the position sensor 14 outputs a detection signal to the pressure controller 40. On receiving the detection signal from the position sensor 14, the pressure controller 40 transmits a drive stop signal to the suction pump 24. By this drive stop signal, the suction pump 24 is stopped and the chamber 30 is brought back to normal pressure.

Page 18, lines 5-9:

When a specified amount of resin 28 has been supplied from the second runner 22b to the second cavity 20b, the position sensor 14 detects that the plunger 12 has reached the position C, as shown in Fig. 6(c). When the position sensor 14 detects that the leading end of the plunger 12 arrived at position C, the position sensor 14 outputs a detection signal to the pressure controller 40.

Page 19, lines 2-9:

Subsequently, when the leading end of the plunger 12 has moved to the position D as shown in Fig. 6(d), which indicates that the second cavity 20b has been filled completely with the resin 28, the position sensor 14 outputs a detection signal to the pressure controller 40. In response to the detection signal, the pressure controller 40 sends a drive stop signal to the suction pump 24. By the drive stop signal, the suction pump 24 is stopped. On the other hand, the chamber 30 is brought back to normal pressure. At the same time, the plunger movement is also stopped, and the resin in the cavities 20a and 20b is cured.

Page 19, lines 23-27:

The shape of the mold is not limited to the one shown in Figs. 5 and 6, but may be a type for producing a package with multiple gates, such as formed in matrix. In this case, [By] by detection of the position of the plunger 12 by the position sensor 14, it is

possible to adjust the pressure of the cavities in a predetermined timing pattern, so that products without voids can be produced.

Page 20, lines 1-5:

According to the third embodiment that has been described, the pressure controller 40 controls the suction pump according to the position of the plunger 12 detected by the position sensor 14. It is also possible to arrange for the pressure controller 40 to control the suction pump according to time counted by the timer 42a shown in Figs. 4(a)-4(d).

Abstract of the Disclosure

A method of transfer molding [apparatus], wherein [said] a top-half mold and a [said] bottom-half mold of an apparatus form a plurality of cavities interconnected, and wherein [said] a pressure adjuster [adjusting means] reduces the pressure of the cavities every time a specified amount of resin is supplied into any one of a plurality of cavities.